

NON-PUBLIC?: N  
ACCESSION #: 9011020102  
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Brunswick Steam Electric Plant Unit 1 PAGE: 1 OF 05

DOCKET NUMBER: 05000325

TITLE: High Pressure Reactor SCRAM While Performing PT-40.2.10 Due To  
Erroneous Procedure Guidance and Defective Turbine Stop Valve  
Switches

EVENT DATE: 09/27/90 LER #: 90-017-00 REPORT DATE: 10/26/90

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: POWER LEVEL: 022

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR  
SECTION:  
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: Theresa M. Jones, Regulatory TELEPHONE: (919) 457-2039  
Compliance Specialist

COMPONENT FAILURE DESCRIPTION:

CAUSE: SYSTEM: COMPONENT: MANUFACTURER:  
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

During a scheduled Unit 1 shut down for a refuel/maintenance outage on September 27, 1990, the reactor scrammed on high pressure at 0348, during the performance of periodic test (PT) 40.2.10, Turbine Control/Stop Valves (TCV/TSV) Leak Tightness Testing. Prior to the event, the reactor was at approximately 22% power and the Emergency Core Cooling Systems (ECCS) were operable in standby readiness. Event recovery was in accordance with site Emergency Operating Procedures, no ECCS or Engineered Safety Feature actuations or isolations other than scram signals occurred. The event was occurred by erroneous procedural guidance, incorporated into the PT from a vendor document, and defective switches on the TSVs which allowed the TCVs to open when the TSVs were closing. This resulted in the turbine bypass valves (BPV) open demand signal being limited by the Maximum Combine Flow circuitry of the turbine

control system. The closure of the TBVs occurred reactor pressure to increase to the SCRAM setpoint. Maximum power attained during the SCRAM was 28%. This event had minimal safety significance as the reactor is analyzed for a high pressure SCRAM from full power. Past high pressure scram events were reviewed and found not to be related to this event. The procedure will be rewritten and the switches will be repaired.

END OF ABSTRACT

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## EVENT

Unit 1 reactor SCRAM due to high pressure during the performance of turbine control/stop valves leak tightness testing.

## INITIAL CONDITIONS

On September 27, 1990, the Unit 1 reactor was being shut down for a scheduled refuel/maintenance outage. The Emergency Core Cooling Systems (ECCS) were operable in standby readiness. The "B" reactor feed pump (RFP) was being held in standby by placing its controller in manual and lowering the pump speed until the discharge pressure was below the forward feed point. The "A" RFP was supplying the vessel in automatic under the control of the master feedwater level controller. At 0225, the generator was removed from the grid. The Unit stabilized at 945 psi, 24% power and 68% bypass. At 0230, the turbine was reset and selected to 1800 rpm in preparation for the performance of PT-40.2.10, Turbine Control/Stop Valves (TCV/TSV) Leak Tightness Test. At 0251, power reduction by rod insertion continued while a second reactor operator (RO) monitored the PT. At 0334, the TCV portion of the PT was completed, unsatisfactory, when the turbine failed to decrease speed to 600 rpm when the TCVs were closed. At 0338, the turbine was returned to 1800 rpm to perform the TSV portion of the PT.

## EVENT DESCRIPTION

At 0346 a jumper was installed, per the PT, in the turbine electro-hydraulic control (EHC) cabinet to cause the number (No.) 2 TSV to close. The No. 1, 3, and 4 TSVs are slaved to the No. 2 and also began to close. At 0347 the BPV position increased to 60% and then returned to 55% open, reactor pressure began a gradual increase to 971 psi. At 0348, BPV position decreased to 31% causing an acceleration of the pressure increase to approximately 5 psi per second. Within ten seconds reactor pressure reached the alarm setpoint of 1025 psi and three seconds later the pressure increased to the SCRAM setpoint of 1035 psi and the Reactor

Protection System (RPS) automatically inserted the control rods. During the SCRAM recovery, a manual SCRAM signal was generated when the mode switch was placed to shut down, in accordance with the site Emergency Operating Procedures (EOPs), and a second RPS signal was generated on SCRAM discharge volume (SDV) Hi-Hi level. After the SCRAM, reactor pressure decreased below the discharge pressure of "B" RFP

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which remained at its manually set speed. At 0351, the "B" RFP overfed the vessel and a high reactor level tripped the "A" and "B" RFP turbines, the main turbine and the high pressure ECCS turbines. At 0357, the RO reset the "A" RFP turbine and placed the Startup Level Control Valve (SULCV) in service. During the event the highest pressure was 1042 psi, the lowest level was 167 inches and the maximum attained power was 28%. No ECCS or Engineered Safety Feature (ESF) actuations or isolations, other than the SCRAM signals, occurred during the event.

#### EVENT INVESTIGATION

PT 40.2.10 was a site procedure which has been performed once on each Brunswick unit. The procedure was based on guidance provided in vendor document GEK-25406A and had an 18 month performance frequency. The test is not a Technical Specification required surveillance.

On September 27, 1990, the test was performed on Unit 1. During the TSV portion of the test, the TSVs were initially full open and the TCVs were "cracked" open to supply enough steam to keep the turbine at 1800 RPM. The turbine bypass valves (BPVs) were being utilized to control reactor pressure to the condenser. When the jumper was installed allowing the TSV to close the TCVs began to open, as expected by PT-40.2.10 and GEK-25406A. However, a review of EHC system logic prints indicates that the TCVs should remain closed any time the TSVs are closed except during the shell warming mode of operation. Therefore, if the equipment functions per design, the PT and GEK are incorrect.

During this performance of PT-40.2.10, the TSV limit switches did not operate properly and as the TSVs closed the TCVs opened in an attempt to maintain the selected speed of 1800 rpm. If the equipment had operated properly an interlock between the TCVs and the TSVs should have automatically lowered the "Load Limit" to zero and prevented TCVs from opening. The interlock was tested after the event and three of the four switches were found to be malfunctioning. The combination of the jumper installed by the procedure and the defect in the TSV interlock circuit allowed the control valve amplifier (CVA) to generate an increasing demand signal to open the TCVs.

Another turbine control circuit called "Maximum Combined Flow" (MCF) monitors the summation of the TCV and BPV demand. The MCF

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setpoint is 110% of rated flow. If the summation exceeds 110%, the BPV position demand will be limited. In this instance the TCVs opened in an attempt to maintain turbine speed at 1800 RPM because of the TSV switch failure to decrease the Load Limit to zero. As the TSVs closed the BPVs should have opened further to maintain reactor pressure. Initially the BPVs did open further, however, as the MCF limit was reached, the BPVs began closing in response to the MCF control circuitry resulting in the observed reactor pressure increase and resulting SCRAM.

A review of the Unit 2 performance of the PT on September 9, 1989, revealed that the MCF setting was at 130% combined BPV and TCV demand instead of the 110% setpoint. The 130% setting allowed the TCVs to open without limiting the BPVs. The setting was restored to the 110% setpoint during the Unit 2 refueling outage.

Past reactor high pressure events were not related to this event.

#### ROOT CAUSE

The root cause of the event was erroneous procedural guidance and defective switches on the TSV.

#### CORRECTIVE ACTIONS

PT 40.2.10 has been removed from use. The procedure will be rewritten to comply with GE vendor recommendation for TCV/TSV tightness test requirements after the vendor instructions are revised such that the test may be satisfactorily performed.

The U-1 TSV limit switches will be repaired. An investigation into the cause of the TSV switch failures will be conducted. The U-2 TSV limit switches will be checked for proper operation.

GE has been requested to inform the industry of the GEK inadequacies. CP&L will initiate an appropriate industry notification if GE does not.

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#### SAFETY SIGNIFICANCE

The safety significance of this event is minimal. The reactor is analyzed for a pressure transient from full power. This event was within the bounds of that analysis. No ECCS or ESF actions or initiations other than the SCRAM signals occurred.

## IIIS CODES

System/Component Code

TCV TRB/CV

TSV TRB/SHV

BPV TRB/\*

RFP SK

EHC TG

RPS JE

SDV AA/\*

SULCV SD/LCV

CVA TRB/CV/AMP

MCF TRB/\*

(\*) IIIS Component Identifier Not Found

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CP&L

Carolina Power & Light Company

Brunswick Nuclear Project  
P. O. Box 10429  
Southport, N.C. 28461-0429  
October 26, 1990

FILE: B09-13510C 10CFR50.73  
SERIAL: BSEP/90-0737

U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, D. C. 20555

BRUNSWICK STEAM ELECTRIC PLANT UNIT 1  
DOCKET NO. 50-325  
LICENSE NO. DPR-71  
LICENSEE EVENT REPORT 1-90-017

Gentlemen:

In accordance with Title 10 of the Code of Federal Regulations, the enclosed Licensee Event Report is submitted. This report fulfills the requirement for a written report within thirty (30) days of a reportable occurrence and is submitted in accordance with the format set forth in NUREG-1022, September 1983.

Very truly yours,

J. L. Harness, General Manager  
Brunswick Nuclear Project

TMJ/

Enclosure

cc: Mr. S. D. Ebnetter  
Mr. N. B. Le  
BSEP NRC Resident Office

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BSEP/90-0737 -2-

bcc: Mr. R. M. Coats Mr. L. I. Loflin Mr. L. V. Wagoner  
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